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language therapists:
Using the evidence-base to treat
speech sound disorders using
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Clinical skills training for speech and language therapists:

Using the evidence-base to treat speech sound disorders using electropalatography (EPG)

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Abstract

Speech sound disorders (SSD) affect a large proportion of children on Speech and Language Therapists (SLTs) caseloads. The impact on the child can be far reaching, disturbing both social and educational development. Traditional therapy interventions are often lengthy and do not always resolve the SSDs. Electropalatography (EPG) is an instrumental visual-feedback technique used mainly in research clinics which has proven effective in the treatment of SSDs.

This research aimed to train six SLTs in the use of EPG to treat children for whom traditional methods had failed. Workshops were offered to all interested SLTs which targeted: increasing knowledge of SSDs and possible barriers to success in therapy; increasing knowledge of EPG, specifically diagnostic benefits and therapy outcomes; helping SLTs to identify children on their caseload who may benefit from EPG. Following these 28 children were referred for consideration from which 3 children were chosen.

Two of the three children responded to EPG therapy and successfully remediated their speech errors within 12 weeks and were subsequently discharged. For the third child who has multiple speech errors and requires ongoing surgical intervention in addition to therapy, EPG proved diagnostically very important as well as allowing progress previously not made in therapy.

It became apparent that data security policies in NHS Lothian are incompatible with the Articulate Assistant software required to run EPG. Therefore whilst this method of intervention proved very successful in remediating the SSDs it cannot currently be adopted into the NHS without further considerations. Alternative visual-feedback techniques are being explored.

1 Background

Children with “speech sound disorders” (SSD) make up a considerable proportion of a Speech and Language Therapists (SLT) caseload which is estimated to be approximately 6.5% of all UK children. Current practice relies on SLTs using auditory perceptual judgements about a child’s speech difficulties to assess and diagnose the nature of the problem and rely on the child’s own auditory perceptual abilities when listening to the therapist’s and their own speech productions. SLTs are very skilled at describing and highlighting speech errors to young children and many children will be able to resolve their speech difficulties. However, for some this is a slow process, taking many hours of SLT time and for others correct productions are never achieved. This can negatively impact on education, social development and self esteem.

1.1 Electropalatography

Electropalatography (EPG) is a long established tool for clinical and non-clinical research. It can provide unique diagnostic data and be used in real-time as a computer based biomedical feedback technique. Together, these properties have been found to be effective in treating articulation disorders that have failed to respond to conventional therapy approaches [1,2,3,4]. EPG records timing and location of tongue contacts with the hard palate during speech and registers characteristic patterns for many consonants in English. It requires the individual to have a custom-made artificial palate (figure 1) which fits against the roof of the mouth. Embedded into the artificial palate are 62 electrodes that register on a computer screen when the tongue is touching them. An individual’s articulation can be compared to standard patterns for English consonants (see figure 2) and error patterns noted. EPG is a particularly valuable diagnostic tool in a clinical setting because it gives objective and detailed analysis of the child’s articulation patterns and may identify errors which cannot be detected by perceptual analysis alone yet are vital for accurate diagnosis and subsequent effective intervention [5].

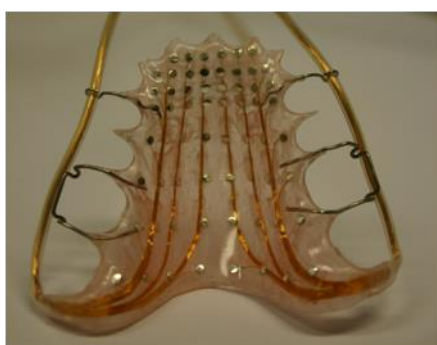


Figure 1. EPG palate

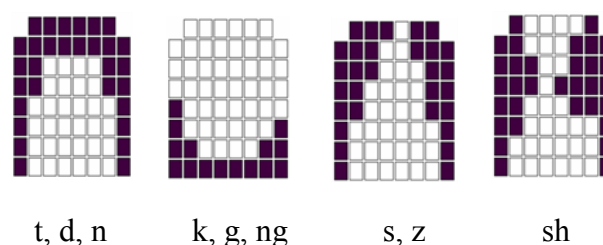


Figure 2. Standard articulatory patterns

EPG can also be used to modify articulatory patterns by using visual feedback. The speech and language therapist (SLT) selects a target articulation pattern characteristic of a particular sound which is currently incorrectly produced and demonstrates what the sound looks like through use of diagrams (figure 2) or a live demonstration on the computer. During therapy the child attempts to copy this correct articulation by visually monitoring their own contact patterns in real time. A portable training unit (PTU - figure 3), can be used in therapy instead of the full clinic-based recording and analysis system and can be sent home with the child for additional practice.



Figure 3. A Portable Training Unit (PTU) used for home practice with parental/carers guidance.

There is good evidence that EPG is an effective form of therapy and it been suggested that EPG therapy may expedite results [6]. However EPG remains a specialised technique not routinely used in clinical practice.

1.2 Aims

NHS Lothian has a full EPG system but due to a change in therapists over several years current SLTs are not trained to use it. Therefore the project aimed to:

1. Offer specialist workshops in speech sound disorders to all NHS Lothian SLTs to enable them to identify which children may benefit from EPG therapy
2. Train a subset of SLTs in the use of EPG for assessment and treatment of children with intractable speech sound disorders
3. Evaluate the use of EPG as a clinical non-research centre tool
4. Contribute directly to evidence-based practice
5. Establish collaborative links between NHS and QMU

2 Methods

Three specialist workshops in SSDs were offered to all SLTs across Edinburgh and the Lothians in June 2013. These workshops were aimed at: increasing SLT knowledge of SSD and possible barriers to success in therapy; increasing SLT knowledge about EPG, its diagnostic benefits and use in remediation of SSDs; helping therapists to identify children on their caseload who would benefit from EPG therapy.

Following these workshops, SLTs in NHS Lothian identified children who they felt may benefit from EPG intervention and details of these children were referred to the Clinical Lead in Speech Sound Disorders. Twenty-eight cases were referred. Each was considered and a short list of eight was identified for consideration. All eight children were visited by Wood and three boys, aged between 9 and 15 years, were selected (P1, P2, and P3). The boys all presented with persistent difficulties in the production of /k/ and /g/, usually be acquired by age 3 years, despite significant amounts of intervention prior to this study.

Six therapists, two each from West Lothian, East / mid Lothian and Edinburgh city were identified to undergo specific EPG training which targeted: demonstration and supervision of EPG assessment; identification of speech production errors; selecting appropriate targets for intervention; devising, structuring and delivering EPG therapy sessions; monitoring clinical outcomes.

3 Results

EPG palates were made for all three boys. However, following this, the eldest participant (P3) stopped attending school where his therapy sessions were conducted. Despite repeated efforts by SLT and school, this child failed to return to school and therefore was withdrawn from the project. A no cost extension to allow another child (P4) to receive EPG therapy was applied for and approved. This child had significantly more complex speech difficulties which were associated with a submucous cleft palate and other structural abnormalities and presented with multiple speech errors and significantly reduced intelligibility.

3.1 Participants P1 and P2

EPG assessment prior to intervention confirmed the auditory impressionistic SLT judgments that the boys were producing a more fronted articulation ([t] or [d]) in place of target /k/ and /g/ (e.g. figure 4). Typical post-therapy productions (e.g. P2 figure 5) resemble adult /k/ or /g/ productions (figure 2).

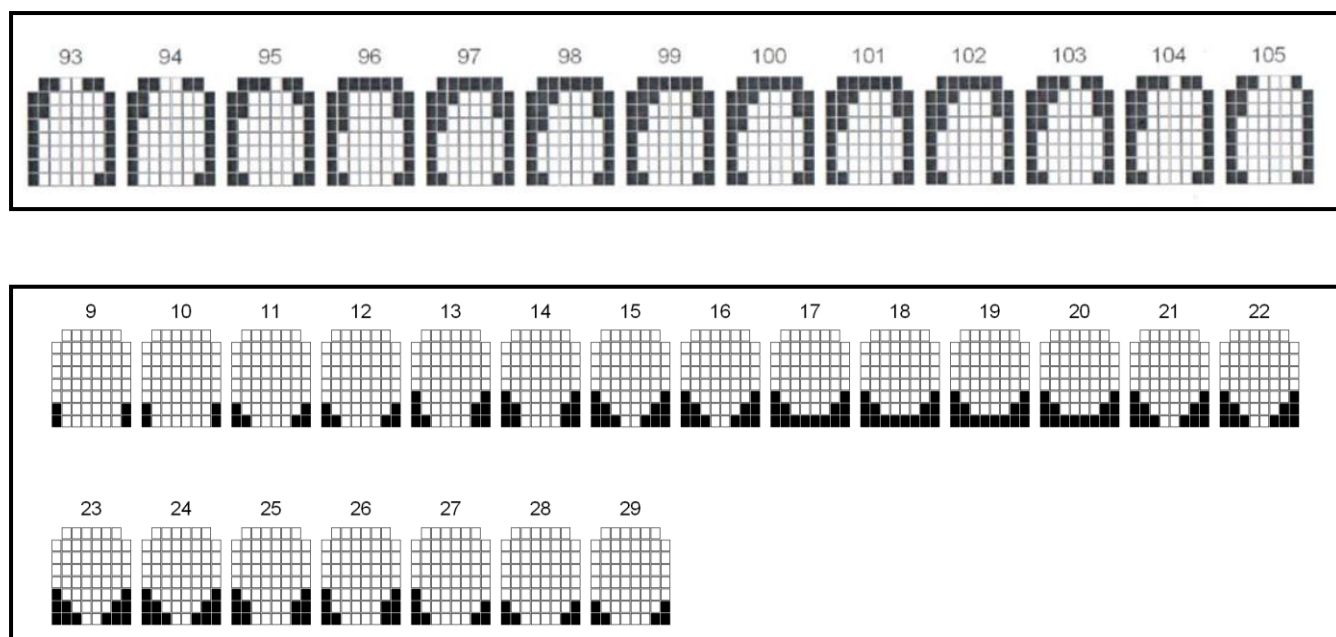


Figure 4: EPG palate contact patterns for word initial /g/ in “go” for P1 (top) and a typical speaker (bottom).

Both P1 and P2 responded well to EPG therapy (see figure 5) and were able to correct the targeted speech error within the 12 sessions and were subsequently discharged from the SLT service. Both of these children had been known to the SLT service for a long time, one boy since the age of two and a half years.

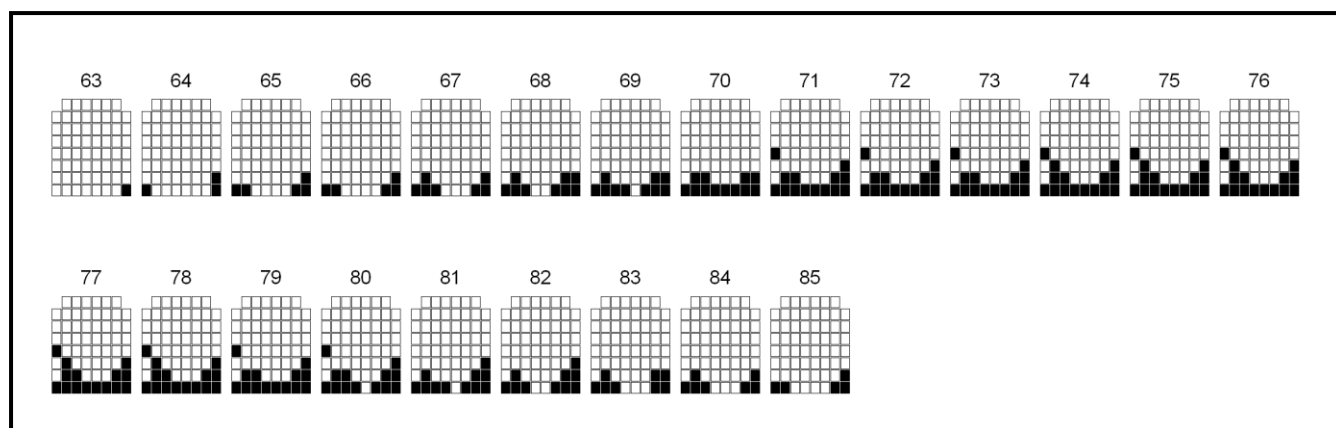


Figure 5: EPG palate contact patterns for word initial /g/ in “go” for P2 post therapy.

3.2 Participant P4

EPG assessment for P4 identified a number of errors that were not audible and diagnostically important. Some assumptions that had previously been made through auditory impressionistic judgments were found to be incorrect and highlighted the importance of instrumental analysis in the assessment of persistent speech disorders. This previously unavailable information was key in setting new therapy targets for P4. P4 outgrew his palate before reassessment was

possible. However, his SLT reported that EPG had been a valuable diagnostic tool, had enabled P4 to receive feedback on tongue position that had been worked on for a number of years with limited progress, and gave the SLT and child a common understanding. The therapist commented that “progress has been made which I would not have achieved without EPG”. Whilst it is recognized that P4 requires surgical intervention, achievable targets to help improve speech production and intelligibility in the interim have now been established.

4 Discussion/ Conclusion

This research aimed to increase SLT’s knowledge of SSDs using the evidence base that has been collected in research clinics utilising electropalatography. Specialist workshops were delivered to therapists to help identify children with persistent speech disorders who may benefit from EPG and training of a subset of SLTs to use EPG in assessment and treatment was carried out. Initial training led to 28 children being referred from which 3 children were selected to receive therapy from the subset of SLTs that were trained. Two of the three children were successful in remediating a persistent speech disorder that had previously been resistant to conventional therapy and were subsequently discharged. The other child continues to have ongoing specific speech difficulties as a result of a medical condition but EPG was invaluable in the assessment, diagnosis and treatment and the child made progress that had previously been unobtainable.

The study was not without challenges which have restricted the reporting of results. Specifically, NHS data security policies in Lothian are incompatible with the Articulate Assistant software required to run EPG. Current NHS data protection policy does not allow data to be saved to a local machine and without this facility the assessment data cannot be recorded, stored and analysed. Currently the only way around this problem would be to undertake pre and post therapy recordings at QMU and therapy to proceed using a PTU in the local NHS clinics although this has ethical considerations.

5 Recommendations

- To continue to develop collaborative links between QMU and NHS Lothian by investigating the use of alternative visual feedback techniques to assess, diagnose and treat SSDs, specifically ultrasound tongue imaging (UTI), which is less expensive, does not require the use of a specialised artificial palate which is time limited, and does not

need to be linked to a computer which prevents data security difficulties.

(<http://www.qmu.ac.uk/casl/ultraphonix/default.htm>)

- Explore funding opportunities for EPG palates. These currently cost c.£500 and SLT budgets do not include these.
- Explore the possibility of collaborative links with other trusts whose data policies allow the use of Articulate Assistant.

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